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Brain Tumor Detection from MRI Images using Artificial Neural Networks

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***Abstract*—Engineers have been actively developing tools to detect cancer cells and to process medical images. Artificial Neural Networks is a powerful tool that is often used to detect cancer cells. This paper is about detecting Brain cancer cells from MRI images using Convolution Neural Network in ANN. Brain Tumor Identification is a challenging task in the early stages of life. Nowadays, the issue of brain tumor identification is of great interest. To detect brain tumor of a patient, we consider the data of patients like MRI images of a patient's brain. Here, our problem is to identify whether cancer is present in patients or not. It is very important to detect cancer at starting level for a healthy life of a patient. The most important part of this project is that all the CNN algorithms work with GUI "TensorFlow CNN". This allows us to use various combinations of filters, and other image processing techniques to arrive at the best result that can help us to detect brain cancers in their early stages.**

I. INTRODUCTION

In recent times, the introduction of information technology and e-health care system in the medical field helps clinical experts to provide better health care to the patient [1-3].

The tumor is an uncontrolled growth of cancerous cells in any part of the body, whereas a brain tumor is an uncontrolled growth of cancerous cells in the brain. A brain tumor can be benign or malignant. The benign brain tumor has uniformity in structure and does not contain active (cancer) cells, whereas malignant brain tumors have a non-uniformity (heterogeneous) structure and contain active cells. Gliomas and meningiomas are examples of low-grade tumors, classified as benign tumors and glioblastoma and astrocytoma are a class of high-grade tumors, classified as malignant tumors [1-3].

According to the World Health Organization and American Brain Tumor Association, the most common grading system uses a scale from grade I to grade IV to classify benign and malignant tumor types. On that scale, benign tumors fall under grade I and II glioma and malignant tumors fall under grade III and IV glioma. The grade I and II glioma are also called low-grade tumor types and possess a slow growth, whereas grade III and IV are called high-grade tumor types and possess a rapid growth of tumors [1-3]. If the low-grade brain tumor is left untreated, it is likely to develop into a high-grade malignant brain tumor. Patients with grade II gliomas require serial monitoring and observations by magnetic resonance imaging (MRI) or computed tomography (CT) scan every 6 to 12 months [6]. Brain tumors might influence any individual at
any age, and their impact on the body may not be the same for every individual.

According to the brain tumor statistics conducted by the American Brain Tumor Association, Brain tumors do not discriminate. They affect all ages, genders, ethnicities. Over 700,000 Americans are living with a brain tumor today. Nearly 80,000 people will be diagnosed with a primary brain tumor this year. There are more than 120 different types of primary brain and CNS tumors. Approximately one-third (32 percent) of the brain and central nervous system (CNS) tumors are malignant. About 28,000 kids in the United States are fighting brain tumors right now. This year, nearly 16,000 people will die as a result of a brain tumor. Survival after diagnosis with a primary brain tumor varies significantly by age, tumor type, location, and molecular markers.

The 5-year survival rate tells you what percent of people live at least 5 years after the tumor is found. Percent means how many out of 100. The 5-year survival rate for people with a cancerous brain or CNS tumor is almost 36%. The 10-year survival rate is almost 31%. Survival rates decrease with age. The 5-year survival rate for people younger than age 15 is more than 74%. For people age 15 to 39, the 5-year survival rate is about 71%. The 5-year survival rate for people age 40 and over is about 21%. However, survival rates vary widely and depend on several factors, including the type of brain or spinal cord tumor.

II. EXISTING SYSTEM

In the Existing System, brain cancer was detected using image processing techniques. Initially, a CT scan image is acquired and the preprocessing techniques are applied to it[7]. Then the preprocessed image is segmented. Then some of the features are extracted. In these systems, the techniques used in the detection of brain cancer were confined to segmentation [4],[5]. These approaches are also suffered from certain issues which can be removed by improving the technology used in it.

Disadvantages

- Many systems are confined only to segmentation.
- They suffer from certain technical issues.
- Some of the systems work only on cancerous images.
- Identification of Staging is not done.
- Less accuracy.
- The area of the tumor isn't computed.

III. PROPOSED SYSTEM

In the proposed method, brain tumor detection follows three basic diagnostic tasks namely preprocessing, feature extraction, and classification. As stated above, the acquired MRI scan image is preprocessed. The preprocessed image is sent to convolution layers then the features from the images are used for classification. At last, we classify the image based upon the extracted features, area. In our proposed algorithm we have tried to solve the problems that we come across in the existed system.

This system is identified whether the tumor is cancerous or not. If the tumor is glioma cancerous, it produces the results as gliomas like the same way meningioma or pituitary tumor is meningioma cancerous, it produces the results as glioma or pituitary. If the tumor is non-cancerous, it produces the results as No Cancer. Based on this information the tumor is curable by giving the proper treatment by the doctors. So, the patients can be curable from the tumor at an early stage in their life.

Advantages:

In our proposed system, we classified the image based upon the area of the tumor.

- More accuracy.
- No technological issue.

IV. SYSTEM DESIGN

A coherent computer-aided diagnosis system is built for brain tumor detection. Computer-aided diagnosis (CAD) is easy for doctors to identify the cancerous cells accurately. This system mainly deals with the identification of the brain cancer stage. The proposed method for brain tumor detection follows three basic tasks namely, preprocessing, feature extraction, and classification.

As stated above, the acquired MRI scan image is preprocessed. Next, we extract the features from the segmented image. At last, we classify the image based upon the extracted features and area. In our proposed algorithm we have tried to solve the problems that we come across in the existed system.

This system is identified whether the tumor is cancerous or not. If the tumor is cancerous, it produces the results as Cancer. If the tumor is non- cancerous, it produces the results as No Tumor. Based on this information the tumor is curable by giving the proper treatment by the doctors. So, the patient can be curable from the tumor at an early stage of life.

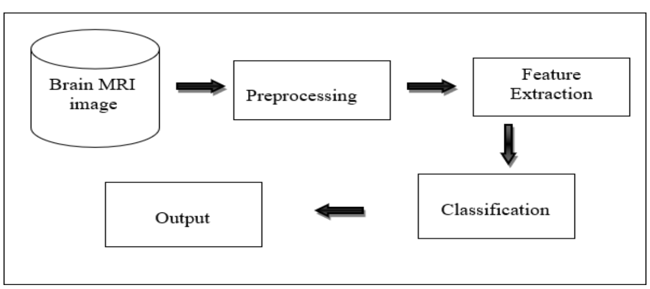


Fig. System Architecture

Description

In the dynamic enroute filtering scheme, the dataflow diagram describes the enroute node receives a report from the source node or the lower associated enroute node and check the integrity of the received report using the MAC enclosed in the report. If the validation succeeds then forward the report otherwise drop the report.

Input Design

Input design plays a vital role in the life cycle of software development, it requires very careful attention of developers. The input design is to feed data to the application as accurately as possible. So, inputs are supposed to be designed effectively so that the errors occurring while feeding as minimized. According to the software engineering concepts, the input forms or screens are designed to provide to have a validation control over the input limit, range, and other related validations.

This system has input screens in almost all the modules. Error messages are developed to alert the user whenever he commits some mistakes and guides him in the right way so that invalid entries are not made. Let us see deeply about this under module design.

Input design is the process of converting the user-created input into a computer-based format. The goal of the input design is to make the data entry logical and free from errors. The error is in the input are controlled by the input design. The application has been developed in a user-friendly manner. The forms have been designed in such a way during the processing the cursor is placed in the position where must be entered. The user is also provided with an option to select an appropriate input from various alternatives related to the field in certain cases.

Output Design

The output from the computer is required to mainly create an efficient method of communication within the company primarily among the project leader and his team members, in other words, the administrator and the client. The output of VPN is the system which allows the project leader to manage his clients in term of creating new clients and assigning new projects to them, maintaining a record of the project validity and providing folder level access to each client on the user side depending on the project allotted to him. After completion of a project, a new project may be assigned to the client. User authentication procedures are maintained at the initial stages themselves. A new user may be created by the administrator himself or a user can himself register as a new user but the task of assigning projects and validation a new user sets with the administrator only.

The application starts running when it is executed for the first time. The server has to be started. The project will run on the local area network so the server machine will serve as the administrator while the other connected systems can act as the clients. The developed system is highly user-friendly and can be easily understood by anyone using it even for the first time.

V. MODULES AND DESCRIPTION

The method of the proposed system for brain tumor detection follows four basic tasks namely, preprocessing, segmentation feature extraction, and classification. As stated above, the acquired MRI scan image is preprocessed. The preprocessed image is segmented. Later, we extract the features from the segmented image. At last, we classify the image based upon the extracted features, area. The overall flowchart of the proposed system is depicted in fig.

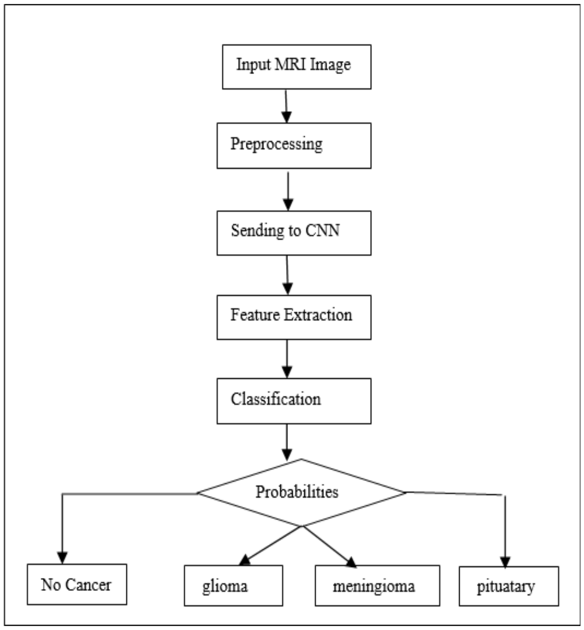
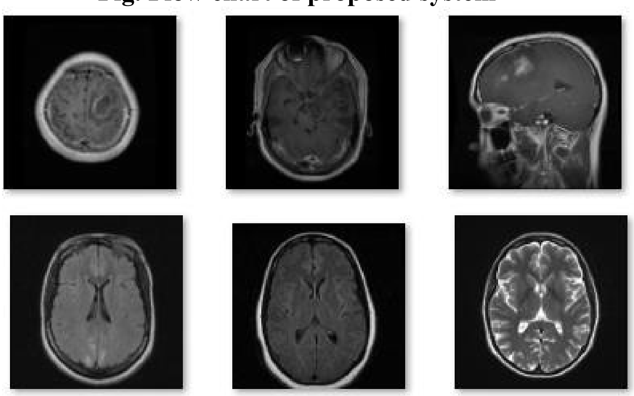


Fig. Flow chart of proposed system



MRI Scan images of brain

A. Preprocessing

In this stage, we majorly focus on image enhancement. The main aim of image enhancement is to give a better perception of the data contained in the image. So that the results are more suitable for further image processing. Here, we convert the color image into the binary image to get a better result. There are different steps involved in this stage. Those are represented in flowchart in following fig

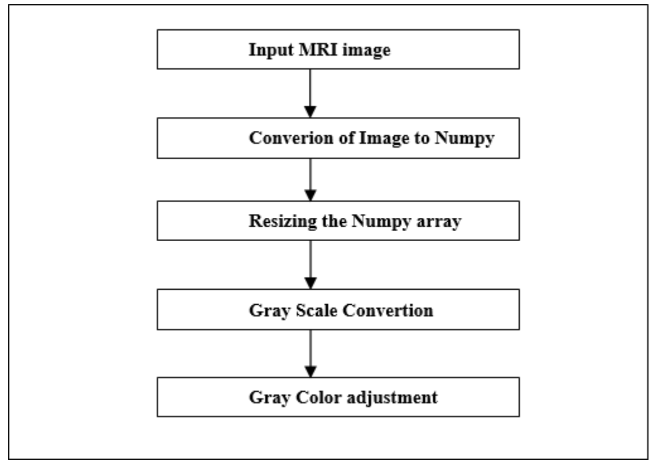
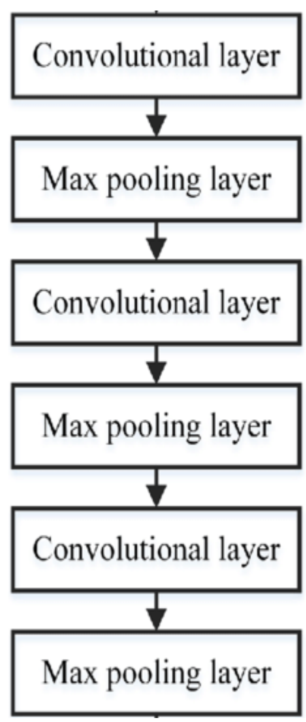


Fig. Steps involved in preprocessing

B. Sending to CNN layers

This stage plays an imperative role in image processing techniques. As the word segmentation itself tells the image is divided into different segments. Here, the division into parts is done based upon the characteristics of the pixels so that we can find the tumor region. Thus, the preprocessed image is converted into a binary image to get the tumor part. There are four steps to be performed in segmentation. The steps are represented in the following Fig



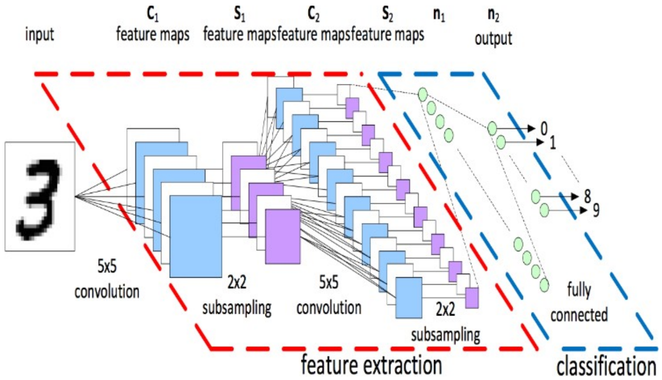


Fig. Convolution Neural Networks

C. Feature Extraction

Feature extraction involves reducing the number of resources required to describe a large set of data. When performing analysis of complex data one of the major problems stems from the number of variables involved. Analysis with a large number of variables generally requires a large amount of memory and computation power, also it may cause a classification algorithm to overfit training samples and generalize poorly to new samples.

D. Image classification

Image classification refers to a process in computer vision that can classify an image according to its visual content. For example, an image classification algorithm may be designed to tell if an image contains a human figure or not. While detecting an object is trivial for humans, robust image classification is still a challenge in computer vision applications.

Here, we are considering the feature area to classify the tumor among the extracted features. Here, we have 4 target classes and they are 0,1,2 and 3. where class 0 represents Glioma Tumor, class 1 represents Meningioma Tumor, class 2 represents No tumor and class 3 represents pituitary Tumor After quantifying the probabilities of the tumor, we had classified the obtained image. We have examined all the MRI images in the dataset with their respective probabilities.

Probability = [[8.32, 2.87, 9.97, 7.77]]

In the above probabilities 3rd class got 97 percent value so we assign third class for the given image

VI. EXPERIMENTAL RESULTS

Image Type	No of images	Detected Image	Accuracy in %
1 Glioma	100	81	81 %
2. Meningioma	115	106	92.%
3 No Tumor	105	103	98%
3 Pituitary	74	70	94

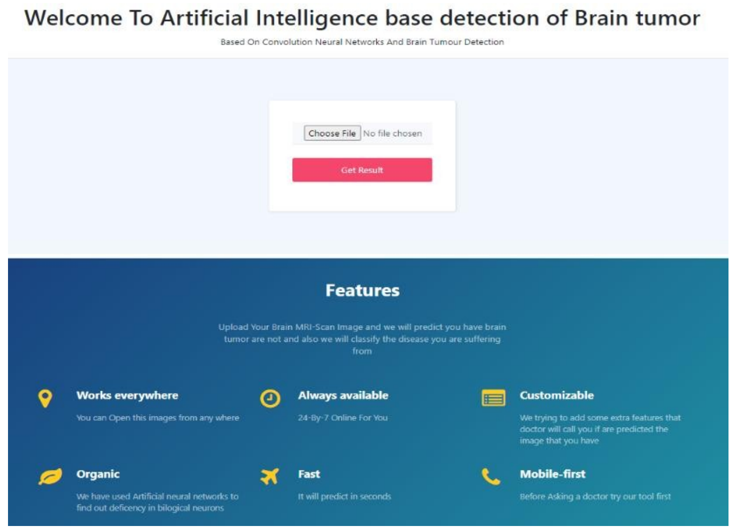


Fig. Loading Main Page (HTML) of our proposed system

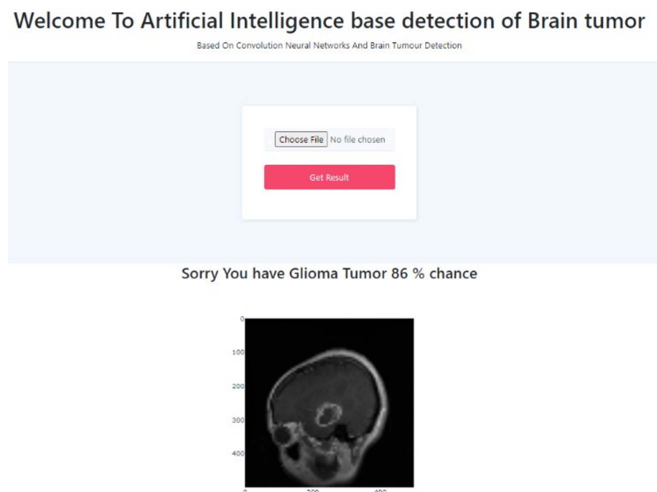


Fig. After Uploading Image, the probability of glioma Tumor

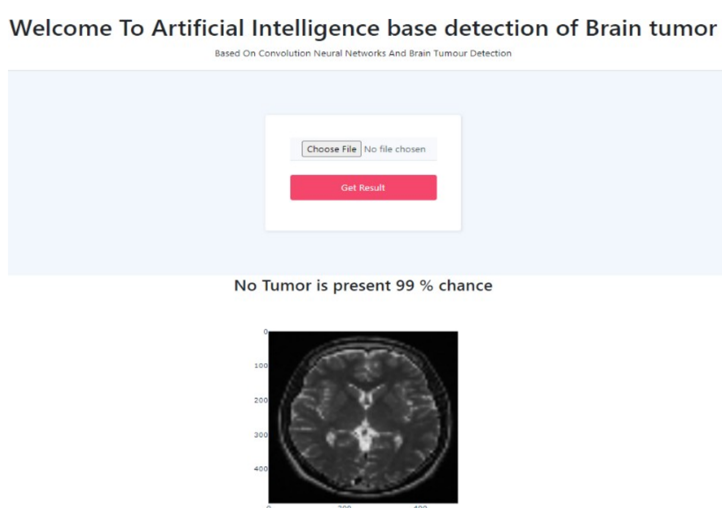


Fig. After Uploading Image The probability of No Tumor

VII. CONCLUSION

In this paper, we proposed an algorithm that can detect brain tumor and gives the outcomes, contrasting other used techniques. This algorithm can easily detect the tumor. If no tumor is found in the input image, then it gives No Cancer. If the tumor is found in the input image, then it gives Cancer. It gives an accuracy of 91.07% as all the images in the testing dataset were detected. The proposed system would betenable in helping doctors recognizing the image whether it is cancerous or non-cancerous. so, the patients can be recovered at an early stage.

VIII. REFERENCES

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